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BABY BEEF.^a

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INTRODUCTION.

Statistics show that the leading meat-consuming and meat-producing people of to-day are those speaking the English language. It is in the countries inhabited by these people that domestic live stock has been brought to the highest state of perfection, and the taste for the meat of these animals has been cultivated to a point which among the well-to-do classes has reached a stage not far below the proverbial luxury of the ancient Romans, inasmuch as specialization in breeding and feeding is necessary to produce that excellence in flavor, grain, and quality essential to please the palate of the modern epicure.

It is interesting to follow the changes that have taken place in the prevailing ideas regarding high-class beef. We are told that during the time of Henry VIII the English people were "strangers to beef and mutton." In those days, according to Youatt, the cattle industry was grossly neglected, and beef, the consumption of which is said to have been confined principally to the summer months, was worth per pound only the equivalent of 3 cents of our present money; but allowance should be made for the fact that the purchasing power of money was greater in those days than it is now. The general form and appearance of the cattle in that period, which are described as "diminutive" in comparison with our modern beef breeds, show the animals to have been little adapted for the production of choice meat, especially when it is considered that the proportion of choice cuts was rather small, and when the time required to put an ox on the market was from five to seven years, the greater part of the time being often spent working in the fields instead of grazing on them; it is therefore quite evident that beef produced under such conditions was tough and inferior, lacking the juicy character which is now desired.

It was about two hundred years later, during the latter half of the eighteenth century, that specialization in growing cattle especially adapted for beef production began, but even then it seems that more attention was given to develop size and quantity rather than quality, the result being those ponderous, rough-appearing specimens with huge bodies, bearing great lumps of meat (and tallow), which still required five or more years to produce, and of which the Newbus ox

^a Reprinted from Twenty-second Annual Report, Bureau of Animal Industry (1905).

(fig. 1), Colling's famous "Durham Ox," or his equally famous "White Heifer that Traveled," were regarded as the most improved examples.

That the ideas regarding excellence of form and quality of meat differed very essentially from our present-day standards is shown by Culley (1794), who states that "short legs are not necessary to excellence in animals," although he was an advocate of fine bone and symmetry of form; these characteristics, as he states it, "being indicative of a more responsive feeder and of producing a finer-grained meat."

Even in Culley's time cattle were not thought fully mature until 5 or 6 years old, and the tender, juicy meat of young animals was considered far inferior to that of older oxen. Highland oxen, which were seldom put into the yoke and of which great numbers were brought into England to be fattened, seldom reached the block before 5 years

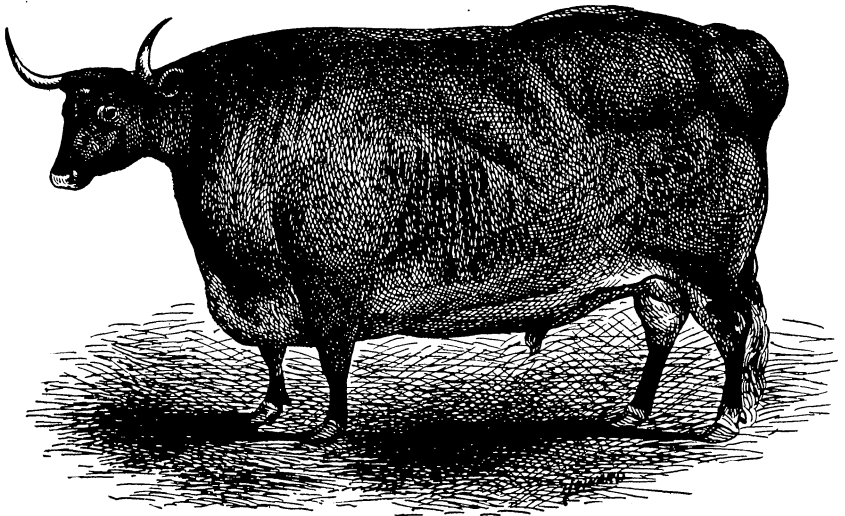


FIG. 1.—Newbus ox.

of age, yet the quality of their meat had become proverbial for its excellence. Animals exhibited at fat-stock shows in those days no doubt underwent a preparation very different from that of the show candidates of to-day. An example may be cited of two oxen exhibited at the Smithfield fat-stock show in 1800, one 5 and the other 7 years old. These animals had been worked three and one-half and two years, respectively, and the preparation for the show consisted in feeding with grass, hay, and a few potatoes for about five weeks previous to the exhibition. To-day such animals could find a place at fat-stock shows only as curiosities.

If fat-stock shows are a fair criterion of market demands in age and type of cattle, their records indicate that at the beginning of the nineteenth century the acme of perfection, both in this country and in England, was the 5 or 6 year old steer weighing 2,500 to 3,000

pounds and often more. In fact, the popular verdict was, "the larger the better." Even up to as recent a period as the early eighties a steer was not deemed mature or profitable enough for slaughter until seasoned by four or five years of life and was still of enormous size and weight.

The Chicago fat-stock show of 1891 led the way in eliminating classes for 3-year-olds, and since that date finished steers above 36 months of age have been the exception rather than the rule on the markets, while 2-year-olds are gradually becoming the maximum. With the reduction in age came a reduction in size, which brought out as the ideal butchers' beast the pony beef, an animal weighing from 1,200 to 1,400 pounds when fully finished. But even the latter weight has been found too large during certain seasons of the year, especially the spring months, for animals that furnish the ideal cuts now in demand, and pony beef was eventually followed by baby beef, the latter being a pony steer finished at a younger age.

That this early mature (baby) beef has taken a strong hold on the consumer and is gradually becoming more popular with the producer was plainly shown at the latest Chicago live-stock show (1905), when the car lots of fat cattle were represented by 24 loads of yearlings, or baby beef, against 31 loads of older cattle. Individual animals or carload lots averaging over 1,800 pounds a head have become almost entirely eliminated from the show ring, and such animals as were fed up to that weight were generally relegated to a back seat in the prize list with the criticism "overdone" or "tallowy." The demand for prime yearlings (baby beef) and the prices at which they sell, as compared with the prices paid for older cattle, indicates that the former prejudice has been cast aside, and the well-finished young meat is as popular to-day as that of cattle of more mature age.

HOW BABY BEEF CAME ABOUT.

The origin of baby beef dates back not more than twenty to twenty-five years. Regarding the first mention of it the National Farmer and Stock Grower says:

Incidental to this subject of baby beef we desire to say that the first time baby beef was mentioned in print in our recollection was in about the year 1884, in a letter written to the editor of the Texas Live Stock Journal, by Mrs. C. Adair, of London, England, widow of John G. Adair, the owner and capitalist of the Adair & Goodnight herds in the Panhandle. Mr. Adair had extensive estates in Ireland, and fattened cattle for sale on the London and Liverpool markets, and at the request of Mr. George B. Loving, then owner of the Texas Live Stock Journal, Mrs. Adair wrote a letter which contained a statement of the process of feeding calves from birth to market which could not be improved upon with all the light obtained by experience and experiment to this day.

Baby beef has been brought to a high state of excellence by the American feeder's art and now has a firm hold on the market. As

we have already seen, the most important and perhaps the most noted progress in the improvement of domestic live stock has been the continuous advance toward early maturity, earlier maturity having been one of the chief objects kept in view by all great improvers of live stock.

Selection and breeding have been the principal means through which the time required for the natural maturing of domestic cattle has been reduced several years. It is also recognized that heavy feeding exerts a marked influence in producing early maturity, this being an artificial method through which animals are matured for the block in less than the normal time.

Numerous reasons have been given as causes of the growing popularity of early fattened baby beef with both consumer and producer. Doubtless it may be said to be based on economic principles.

The first step toward baby beef was the demand for and production of smaller and more compact animals, already referred to as pony beef. The butchers claimed that this change was a good one for economical reasons, because small, compact carcasses cut up with less waste fat and furnish the thick, light steaks which are most in demand by the consumer because of their greater cheapness. As the demand regulates the price, it was natural that the producer should furnish the smaller and more compact carcass for which there was a steady demand and for which he would receive a good price.

Again, experimental evidence shows that young animals will feed more economically than those more mature in age, so that baby beef will give from 25 to 50 per cent more meat for the grain consumed than the same animal would if kept until two or three years of age. This was the economical solution of the problem of cheapening the production of meat. Therefore the greater profit in small joints, together with the greater economy of producing young beef, may be regarded as the most potent factors in bringing about baby beef.

WHAT IS BABY BEEF?

Baby beef is a prime butchers' beast, thoroughly fattened and ripe for the block at from 12 to 24 months of age. Growth has been artificially promoted by continuous heavy feeding from birth, with the object of obtaining in the shortest time possible the maximum amount of well-matured beef. The customary ages at which cattle are put on the market are as 2-year-olds or 3-year-olds, the greater part of the time being required for natural growth, while about four to six months at the end are devoted to fattening. In the production of baby beef the fattening process is begun at birth and carried on simultaneously with growth. In order to make calves

thoroughly prime and fit for the block as yearlings it is absolutely essential that they be always fed to the limit of their ability of transforming food into beef.

The Breeder's Gazette of December 14, 1904, makes the following comments on the nature and production of baby beef:

The making of baby beef is a continuous performance with shows three hundred and sixty-five days in the ordinary year and three hundred and sixty-six days in the leap year. * * * It is readily observable that there is no such thing as "warming up" or "short-feeding" calves intended for the buyers of prime baby beef. * * * Cattle may be 16 or 18 months of age and afterwards warmed up a bit, but they will not class as baby beef and they will not bring the prices of that article.

Baby beef is a special article in which the essential characteristics are early maturity, quality, finish, and thickness of flesh. Nine out of ten yearlings sent to market for slaughter do not class as baby beef, because they lack finish or quality, while some are overfed or "overdone." This results from lack of a proper understanding of the qualities that constitute the condition known as "ripeness" or "finish." It thus happens also that much disappointment in regard to prices often results from marketing such unfinished and overdone cattle.

EARLY MATURITY.

Maturity for the block in beef cattle means that condition when they have reached full growth of body and are thoroughly fat or ripe for slaughter. The average age at which cattle are now fully grown and fattened for the market is between two and three years. Early maturity, therefore, means that the animal has been fully grown and fattened in less than the average length of time required by that class of stock.

In addition to the factors already mentioned through which early maturity can be produced—namely, selection, breeding, and feeding—there is a great difference between individual animals in their tendency to mature early. Small-framed, compact animals that possess quality, indicated by fine bone, a soft, mellow hide, and silky hair, generally mature in less time than is required by the average of the breed. Feeding is the strongest means by which advantage can be taken of this tendency in an animal to hasten its maturity. Another way of producing stock that will mature early is by breeding very young animals, but this is not recommended, because it is a dwarfing process and therefore associated with more or less chance as to the result.

When early maturity is attempted by means of liberal feeding with nutritious feed, carbonaceous in character and lacking in bulk, the tendency to produce flesh and fat is readily developed; but owing to the smaller proportion of nitrogenous constituents contained in such feed and its lack of bulk the animal's frame does not make a propor-

tionate development, and its natural growth is checked at the expense of the development of flesh and fat. Consequently a slight reduction in size and greater fineness of bone are generally associated with early maturity.

When very heavy feeding is resorted to there is always the danger of overfeeding, which often results in permanent injury to the animal.

BREEDS AND TYPES BEST SUITED FOR BABY BEEF.

The comparative value of breeds for the production of beef has been studied at various State experiment stations. The results so far obtained in regard to early maturity indicate that it is not so much a matter of breed as of type.

Early maturity is generally found in animals that combine a good feeding and assimilative capacity with a certain fineness of quality.

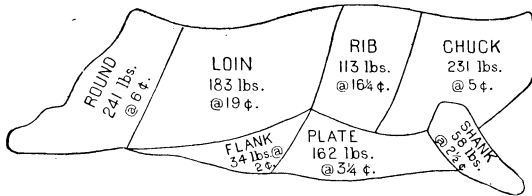


Fig. 2.—Chicago wholesale dealers' method of cutting beef.

Each of the various beef breeds offers more or less diversity in this respect, some individuals in each conforming more closely to this type than others of the same breed.

While early maturity is not entirely a matter of size, it is most often found in individuals a little smaller than the average of the breed. Good specimens of such have a compact form, fine bone, soft, pliable skin, and good digestive capacity, the latter being indicated by well-sprung ribs, great depth of body, and wide chest. Large animals which are more or less rangy in appearance and heavier in bone generally mature somewhat more slowly.

Another phase of the comparative value of breeds is the butchers' idea of type in regard to profit. This type represents the animal that will turn its feed to best account by developing a comparatively large per cent of meat in those cuts which sell for the highest prices. (See figs. 2 and 3.)^a Thickness of flesh over back and loins carried well down over the ribs and well-rounded hind quarters with flesh to the hocks are the qualities which make the animal of most value on the block. It is therefore evident that the further we recede from the extreme dairy type with the protruding spinal column, narrow back,

^a These illustrations are reproduced from Farmers' Bulletin No. 71, first issued in 1898. Since that time prices of beef have advanced, but it is believed that the relation between the prices of various cuts, as shown in the figures, has not materially changed.

and thin cat-hams the greater will be the proportionate weight of high-priced meat and the smaller the percentage of waste. It is in this feature that the beef breeds are superior to the dairy types and scrubs. Experimental evidence indicates that animals of inferior beef type may make as large gains per pound of feed consumed or as

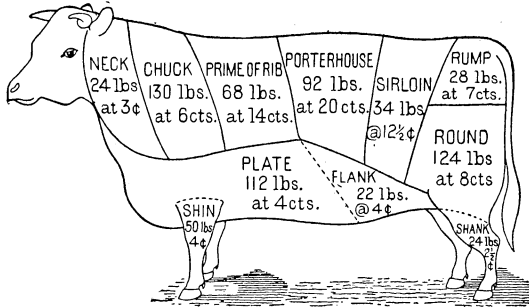


Fig. 3.—Chicago retail dealers' method of cutting beef.

rapid daily gains as well-bred beef animals, but while the beef steer turns his feed into thickness of flesh, the dairy or scrub develops his frame and fattens on the inside, thus accumulating too much loose tallow around the internal organs. This is illustrated in the following tables, taken from Bulletin No. 22 of the Iowa Experiment Station:

Carcass comparison of various beef and dairy breeds and valuation by three expert buyers at the stock yards.

Breed.	Average live weight.	Average dressed weight.	Dressed percentage.	Experts' valuation per hundred-weight.	Loose tallow.	
	Pounds.	Pounds.			Pounds.	Per cent.
Hereford.....	1,525	1,022	67.0	\$6.62	129	12.6
Shorthorn.....	1,660	1,092	65.8	6.37	145	13.3
Galloway.....	1,635	1,088	66.5	6.37	147	13.5
Aberdeen Angus.....	1,725	1,137	65.9	6.37	156	13.8
Red Polled.....	1,520	990	65.1	6.25	125	12.6
Swiss.....	1,570	1,017	64.8	6.00	119	11.7
Devon.....	1,290	815	63.2	5.75	122	15.0
Holstein.....	1,410	862	61.1	5.00	155	17.9
Jersey.....	1,430	880	61.5	4.50	165	18.8

Percentage and value of the various cuts in Shorthorn and Holstein steers.

Cuts.	Shorthorn.		Holstein.	
	Percentage.	Value.	Percentage.	Value.
Loins.....	17.1	\$35.48	16.6	\$27.18
Ribs.....	9.9	15.78	10.2	14.29
Rounds.....	22.9	15.00	23.3	12.05
Chucks.....	21.1	11.52	21.9	9.44
Plates.....	15.4	5.37	14.2	4.08
Shanks.....	5.7	1.55	6.4	1.38
Minor cheap parts.....	7.9	1.73	7.4	1.28
Total.....	100.0	\$6.43	100.0	\$6.70

Value per hundredweight of live weight on the basis of total value: Shorthorn, \$5.21; Holstein, \$4.94.

These tables indicate that there is little or no difference between the breeds which are bred principally for beef, while dairy-bred animals yield a greater amount of waste and a proportionately smaller weight in the high-priced cuts, as is illustrated by the comparison between the Shorthorn and the Holstein in the last table. This point is also emphasized by the packers, who make practically no discrimination between Angus, Shorthorn, Hereford, or Galloway.

From the butcher's point of view there is no difference between purebred, grade, crossbred, or common stock, provided they all possess the same beef qualifications. From the breeder's and the feeder's points of view the choice is decidedly with purebred animals, as they are most likely to breed and develop true to type and to present a uniform appearance. At present the feeder relies principally on grade stock, and when such animals possess a high concentration of the blood of any one breed they are generally equal to pedigreed animals for feeding purposes. Crossbreeding is not very common in this country. In England, where it is more generally practiced for the production of special beef qualifications, excellent results have been obtained; but unless the breeds are well selected bad results are liable to follow, especially after the first cross. Stress is often laid on the importance of uniformity in color, although the packers claim that it does not increase the value except as it might catch the eye of the buyer.

HEIFERS AS GOOD AS STEERS FOR BABY BEEF.

Under present conditions the market does not discriminate between steers and heifers for baby beef, as the latter sell for equally high prices as the steers, provided they are equally well finished. Heifers under 2 years of age fatten more readily and take on a better finish than steers of the same age. They possess finer bone, and consequently dress with less waste. Heifers are therefore as well adapted as steers for the production of baby beef, and this provides the most suitable method for disposing, at profitable prices, of heifers not intended for breeding.

QUALITY IN MEAT.

The problem that puzzles the average feeder more than any other is how to gauge accurately what is known as "condition" in animals. He is unable to distinguish between the criticisms which he generally hears at the stock yards, such as "lack of finish" and "overdone," and the condition known as "prime" or "ripe." It has already been stated that the consumers demand lean meat. Fat or tallow as a food by itself is generally regarded as unwholesome and unpalatable. Lean meat, without a due admixture of fat, is dry, tends to

be fibrous, and lacks flavor. It is therefore evident that the ideal cut is one in which fat and lean are interwoven in such proportions that the lean forms the basis of nourishment, while the quantity of fat present is just sufficient to render the lean meat juicy, tender, and palatable, imparting to it flavor and life.

MEANING OF THE TERMS "PRIME," "UNFINISHED," AND "OVERDONE."

If the lean muscle fibers are regarded as the skeleton upon which to build, the fattening process consists of filling in between these fibers, and when the amount of fat interwoven is such that it has completely filled out and swelled the muscle the condition attained is that known as "prime;" when the filling out is not complete, and the proportion of fat to lean is too small to make the meat juicy and palatable, the criticism is "lack of finish;" but if the deposition of fat is carried beyond the "prime" point, fat is formed into layers and lumps in excessive quantities on the outside of the muscle, and the condition is criticised as "overdone." Craig states the following regarding the external indications of these conditions:

If the covering of flesh is evenly distributed over the steer and it is springy and mellow to the touch, it is considered ready for the block (prime). If in denting the side with the finger the dent lingers some time, the condition is due to soft, flabby fat that brings but a small price at the butcher's stalls.

When this latter condition is found all over the animal it is a strong indication that the animal is overdone and has been fed beyond the profitable, or prime, point. Lack of finish is marked by too firm a touch, one wanting in elasticity. Successful production of baby beef requires great thickness of natural flesh, and this must be obtained by combining breeding with feeding. Condition, however, depends upon the judgment exercised in feeding.

The best way to become thoroughly familiar with these conditions is to examine and handle cattle both before and after slaughter. Ample opportunities for this are afforded at fat-stock shows, where cattle are judged before and after slaughter and where competent judges give their opinion on the merits and demerits of individual animals.

CHARACTERISTICS OF BEEF FLESH.

The meat of each species of animal possesses distinctive characteristics and peculiarities which, even in a single breed, are more or less modified by such factors as sex, age, feed, condition of health, and environment. The characteristics by which we describe beef are color, texture, quality of the grain, and flavor, while the streaky mixture of fat and lean meat is termed its "marbling." The combination of these factors determines the value and quality of the flesh

as an article of food. Edelman describes the quality of beef as follows:

Beef in general has a deep red color, with a light touch of brown, texture firm, cut surface glossy, smell characteristic, as is also its marbling (the mixture of fat and lean). The connective tissues are white in color and moist. The fat (tallow) after cooling is hard, white to yellowish in color, and has a characteristic smell. In old cattle the fat is a deeper yellow, and softer. Deep yellow coloring of fat may also be found in pastured cattle. Liberal feeding with mash, oil cake, peanut cake, and cottonseed cake produces a soft, loose, yellow fat. The bone marrow, which varies in color from clear white to a reddish yellow, is stiff and crumbly.

In old, mature animals the flesh is dark red, the grain is moderately coarse, and the muscles through age and use have become harder and

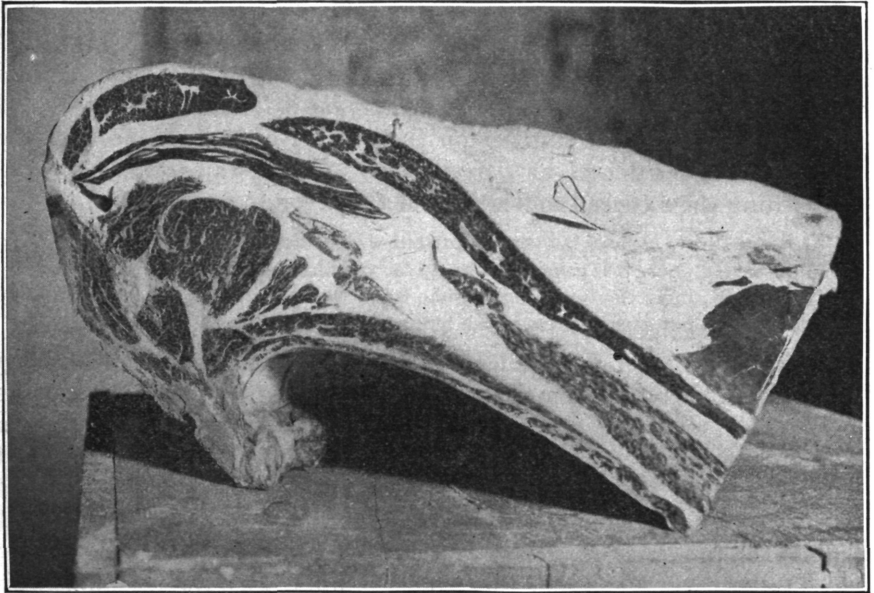


FIG. 4.—Cut of beef (rib) showing appearance known as “marbling.”

more fibrous. The fat, which has partly replaced the water in the muscle tissue, is much greater in proportion to the lean, and it is also found collected in larger deposits between the layers of muscle, the streaky mixture of the white fat and the darker colored lean meat giving the appearance known as “marbling.” (See figs. 4 and 5.)

The flesh of young cattle, when compared with that of old steers, is brighter in color, and, like the young plant, is filled with juices. It has not developed that coarseness of grain and fiber characteristic of the flesh of old animals, and is therefore more tender and delicate. The proportion of fat to lean is smaller in the young animals and the fat does not accumulate in such large deposits or lumps between the layers of muscle, but is more evenly distributed in flakes between

the muscle fibers. The flesh of young cattle contains a large amount of water, which, as the animal grows older, is partly replaced by fat. This is illustrated by the following table, compiled from Bulletin No. 28, Office of Experiment Stations, which shows the comparative composition of the various parts of the carcass in beef and veal:

Comparative composition of beef and veal.

Cuts (edible portion).	Water.		Protein. (N. X 6.25.)		Fat.		Fuel value per pound.	
	Beef.	Veal.	Beef.	Veal.	Beef.	Veal.	Beef.	Veal.
	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Calories.</i>	<i>Calories.</i>
Rib:								
Lean.....	67.9		19.6		12.0		870	
Medium fat.....	55.5	72.2	17.5	20.7	26.6	6.1	1,450	640
Fat.....	48.5	60.9	15.0	18.7	35.6	19.3	1,780	1,160
All analyses.....	57.0	69.8	17.8	20.2	24.6	9.4	1,370	775
Loin:								
Lean.....	67.0	73.3	19.7	20.4	12.7	5.6	900	615
Medium fat.....	60.6	69.0	18.5	19.9	20.2	10.8	1,190	825
Fat.....	54.7	61.6	17.5	18.7	27.6	18.9	1,490	1,145
All analyses.....	61.3	69.5	19.0	19.9	19.1	10.0	1,155	790
Round or leg:								
Lean.....	70.0	73.5	21.3	21.3	7.9	4.1	730	570
Medium fat.....	65.5	70.0	20.3	20.2	13.6	9.0	950	755
Fat.....	60.4		19.5		19.5		1,185	
All analyses.....	67.8	71.7	20.9	20.7	10.6	6.7	835	670
Hind quarters:								
Lean.....	66.3		20.0		13.4		935	
Medium fat.....	59.8		18.3		21.6		1,250	
Fat.....	52.1		17.7		30.7		1,625	
All analyses.....	62.2	70.9	19.3	20.7	18.3	8.3	1,130	735
Fore quarters:								
Lean.....	68.6		18.9		12.2		865	
Medium fat.....	60.4		17.9		21.4		1,235	
Fat.....	53.5		15.9		30.0		1,560	
All analyses.....	62.5	71.7	18.3	20.0	18.9	8.0	1,135	710

The table indicates that the relative proportion of protein is nearly the same in veal as in beef, the proportionate amount being a little larger in veal. The amount of water in the composition of veal averages about 9 per cent higher than in beef, it being replaced in the latter by a correspondingly larger proportion of fat, thus giving the beef a higher nutritive efficiency, as is indicated by the columns showing caloric values.

In the early matured, thoroughly fattened yearling this process of filling up with fat between the muscle fibers has been completed before the muscle has become hard and coarse in the fiber through age and use, and if the young animal is sufficiently fat its meat will be more juicy, tender, and palatable than that of an animal more advanced in age.

Animals which are fattened after they have completed their full natural growth are more likely to develop excessive fat and to become patchy or uneven than animals which are fattened while growing, as the nutritive material of the feed is directed largely to the production of fat. Animals which have not completed their full natural growth utilize the protein constituents of feed in the production of bone, muscle, hair, horn, connective tissue, etc. Thus fat forming is not only deprived of this source of origin, but as this part of the feed consti-

ments is employed in enlarging the framework upon which the fat is deposited, it is evident that fat can not become excessive so long as the animal is growing in frame. This also accounts partly for the fact that some feeders find it difficult to thoroughly finish yearling animals which are rapidly growing in frame.

LESSONS FROM THE FAT-STOCK SHOWS.

One of the principal things to be learned from the fat-stock shows held during the last five years is the increasing necessity for producing early matured beef. The rapid progress made along that line, especially in the range-cattle exhibits, indicates the great improvement brought about in live stock. Yearlings have alternated with 2-year-

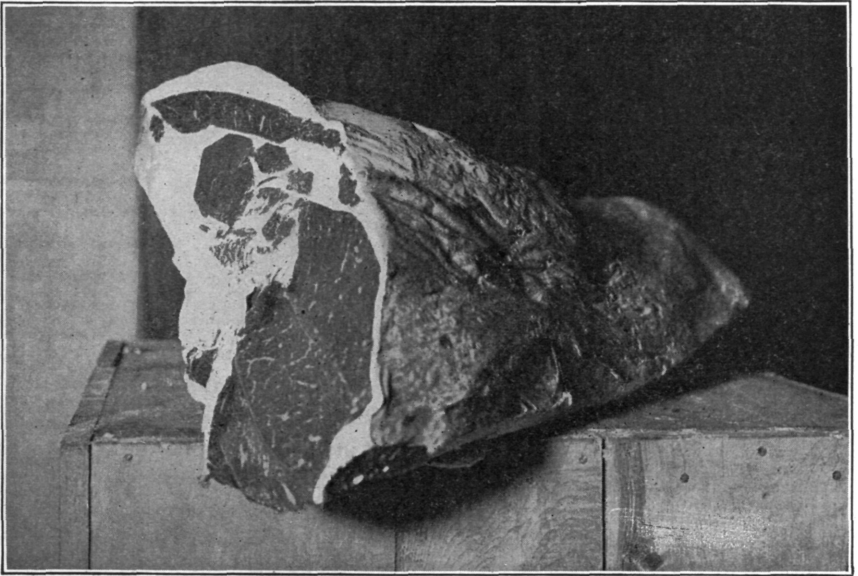


FIG. 5.—Cut of beef (loin) showing appearance known as “marbling.”

olds in taking the prizes for carload lots. While the grand championship honors have been won by animals weighing upward of 1,800 pounds, yet carload lots averaging over 1,500 pounds per head have generally been discriminated against on the ground of overweight, other things being equal. This is especially significant when it is considered that carload lots are generally judged by professional stock-yard buyers, who judge them on the basis of the market demands. The general tendency has been toward producing the largest amount of beef in the shortest time possible, and as a result carloads of yearlings from 18 to 22 months of age are exhibited averaging from 1,200 to 1,300 pounds. On the other hand, 2-year-olds, if fed with a similar object in view, especially when upward of 30

months old, often run above the desirable "handy weights" demanded by the trade.

The following table shows the results of the slaughter tests at the International Live Stock Expositions for the years 1901 to 1905, inclusive.

A comparison is made between the yearlings and 2-year-olds, showing in each case the live weight, the dressed weight, the per cent of dressed weight, and the weight and per cent of tallow. The total number of animals used in this comparison is 36 yearlings and 35 2-year-olds, and the information given comprises the individual figures, the annual averages, and the average for the five-year period.

It is to be regretted that the reports do not give the exact age of the animals in days, as this would make the data a trifle more complete and also make it possible to compile an additional column showing the average gains of the animals.

Comparison of yearlings and 2-year-olds in slaughter test at International Live Stock Exposition, Chicago, 1901 to 1905.

[Compiled from the Breeder's Gazette.]

Placings.	Live weight.		Dressed weight.		Per cent dressed.		Weight of tal- low.		Per cent of tal- low.	
	Two-year-olds.	Year- lings.	Two-year-olds.	Year- lings.	Two-year-olds.	Year- lings.	Two-year-olds.	Year- lings.	Two-year-olds.	Year- lings.
1901.	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>			<i>Lbs.</i>	<i>Lbs.</i>		
First.....	1,620	1,165	1,023	774	63.15	66.44	142	91	8.77	7.73
Second.....	1,450	1,290	933	806	63.34	62.48	92	87	6.34	6.74
Third.....	1,390	1,120	867	687	62.37	61.34	145	110	10.43	9.82
Very highly com- mended.....	1,710	1,240	1,050	789	61.46	63.63	100	93	9.36	7.50
Highly commended.	1,625	1,415	1,097	906	67.51	64.03	118	87	7.26	6.15
Average.....	1,559	1,246	994	792	63.77	63.00	131	94	8.43	7.51
1902.										
First.....	1,555	1,270	1,012	825	65.08	64.96	118	87	7.59	6.85
Second.....	1,380	1,430	904	955	65.51	66.78	72	110	5.22	7.69
Third.....	1,355	1,145	830	759	61.25	66.29	127	79	9.37	6.90
Very highly com- mended.....	1,350	1,055	814	665	60.30	61.03	88	87	6.52	8.25
Highly commended.	1,080	1,080	667	665	61.76	61.57	76	72	7.04	6.67
		1,285		835		64.98		86		6.69
		1,400		916		65.43		87		6.22
		1,550	1,002			64.64		127		8.19
		1,095	686			62.65		71		6.48
Average.....	1,344	1,257	845	812	62.90	64.62	96	90	7.15	7.11
1903. ^a										
First.....	1,345	1,215	926	816	68.88	67.16				
Second.....	1,432	1,551	935	1,008	65.29	64.99				
Third.....	1,630	1,380	1,088	917	66.75	66.45				
Very highly com- mended.....	1,485	1,406	1,011	953	68.08	67.78				
Highly commended.	1,590	1,230	1,075	778	67.61	63.25				
	1,355		887		65.48					
	1,553		1,023		66.36					
	1,683		1,102		65.48					
	1,592		1,078		67.72					
	1,865		1,304		70.00					
Average.....	1,551	1,356	1,044	894	67.31	65.95				

^a No figures for tallow were given in 1903.

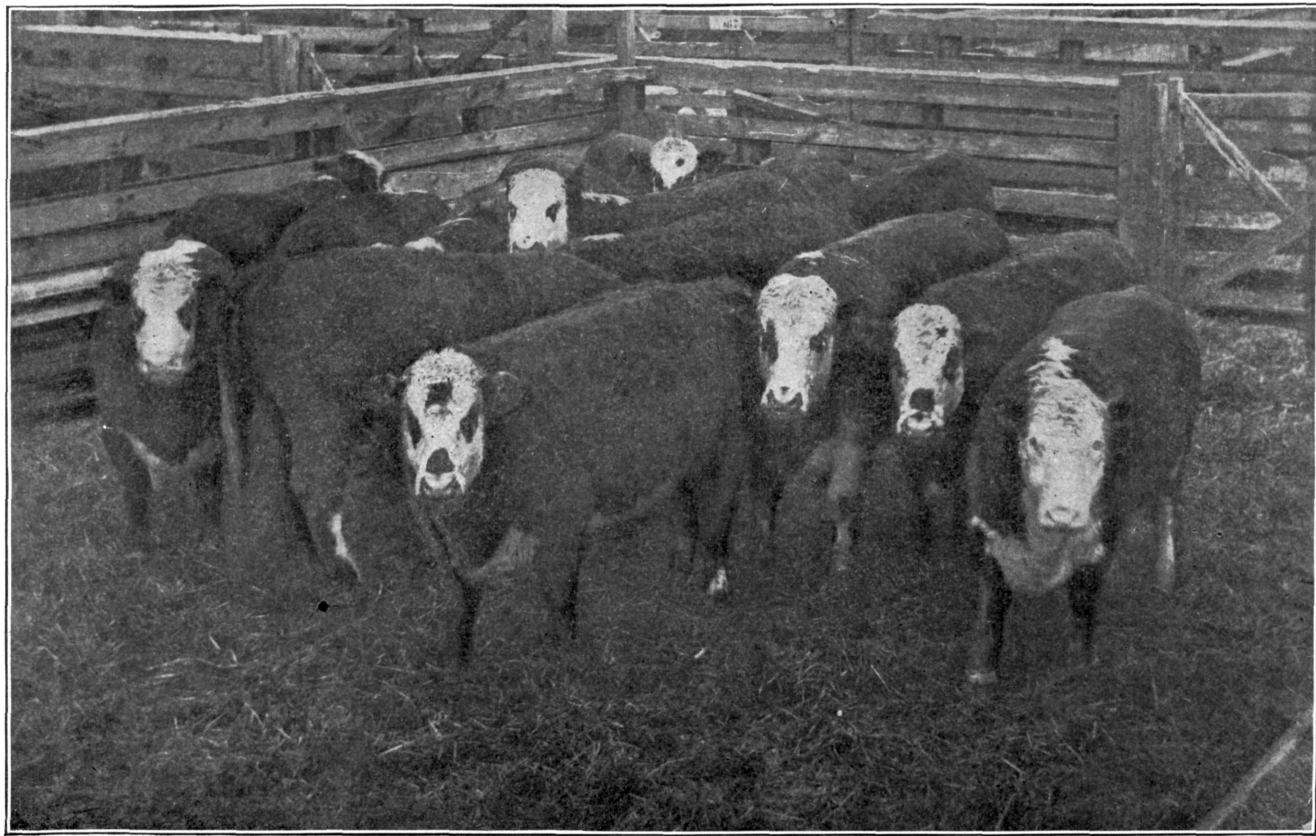


FIG. 6.—Carload of yearlings that took first prize at International Live-Stock Exposition, Chicago, 1901. Average live weight, 1,338 pounds; average dressed weight slightly over 800 pounds.

Comparison of yearlings and 2-year-olds in slaughter test at International Live Stock Exposition, Chicago, 1901 to 1905—Continued.

Placings.	Live weight.		Dressed weight.		Per cent dressed.		Weight of tal- low.		Per cent of tal- low.	
	Two- year- olds.	Year- lings.	Two- year- olds.	Year- lings.	Two- year- olds.	Year- lings.	Two- year- olds.	Year- lings.	Two- year- olds.	Year- lings.
1904.	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>			<i>Lbs.</i>	<i>Lbs.</i>		
First.....	1,235	1,200	824	799	66.70	66.60	105	79	8.50	6.58
Second.....	1,610	1,320	1,046	865	66.40	65.50	115	71	7.14	5.38
Third.....	1,360	1,050	875	689	64.40	65.60	83	73	6.10	6.95
Very highly com- mended.....	1,625	1,245	1,074	806	65.70	64.50	93	79	5.72	6.35
Highly commended.	1,680	1,285	1,075	822	64.00	64.00	152	76	9.05	5.91
	1,656	1,100	1,089	716	66.00	65.10	76	79	4.61	7.18
	1,740	1,190	1,154	710	65.70	59.70	128	79	7.36	6.64
	1,650	1,070	1,107	661	67.00	61.80	131	59	7.94	5.51
		1,245		760		61.00		73		5.85
		1,350		828		61.50		71		5.26
		1,150		706		61.40		51		4.43
Average.....	1,569	1,200	1,030	760	65.61	63.32	110	72	7.04	5.98
1905.										
First.....	1,310	1,250	874	807	66.70	64.88	53	54	4.04	4.29
Second.....	1,300	1,640	853	1,112	65.61	68.70	34	48	2.61	2.92
Third.....	1,540	1,090	983	733	63.83	67.25	69	34	4.48	3.12
Very highly com- mended.....	1,595	1,365	1,032	855	64.70	62.63	70	43	5.00	3.13
Highly commended.	1,630	1,110	1,025	715	61.72	64.41	58	41	3.55	3.70
	1,410	1,200	882	775	62.55	64.58	38	32	2.70	2.66
	1,430		993		69.44		52		3.63	
Average.....	1,459	1,276	949	833	65.04	65.28	55	44	3.66	2.87
ANNUAL AVERAGES.										
1901.....	1,559	1,246	994	792	63.77	63.60	131	94	8.43	7.51
1902.....	1,344	1,257	845	812	62.90	64.62	96	90	7.15	7.11
1903.....	1,551	1,356	1,044	894	67.31	65.95	(a)	(a)	(a)	(a)
1904.....	1,569	1,200	1,030	760	65.61	63.32	110	72	7.04	5.98
1905.....	1,459	1,276	949	833	65.04	65.28	55	44	3.66	2.87
Five-year av- erage.....	1,507	1,255	980	808	65.40	64.41	96	75	6.42	5.94
Average ex- cess of 2- year-olds over year- lings.....	252		172		.99		21		.48	

a Not given.

It will be seen from the above table that the average for the five-year period shows that the 2-year-olds had an advantage of 252 pounds in live weight, the average varying from 87 pounds in 1902 to 369 pounds in 1904. In average dressed weight per head for the five years the 2-year-olds were 172 pounds heavier, varying from 33 pounds in 1902 to 270 pounds in 1904.

In the percentage of beef dressed the 2-year-olds had an advantage practically of 1 per cent for the whole period. In 1901 the two classes dressed very nearly equal; in 1902 the yearlings dressed 1.72 per cent higher; in 1903 the 2-year-olds dressed 1.36 per cent, and in 1904 2.29 per cent higher, while in 1905 the yearlings again had an advantage of 0.24 per cent.

In the tallow yielded the yearlings had a decided advantage—

assuming this to be a waste product, as butchers generally do—and if the figures for tallow were given for 1903 the margin in favor of the younger cattle would probably be still greater, as the 2-year-olds in that year were above the average weight and also double the number of the yearlings. For the four years for which the figures for tallow are given the average amount per head is 21 pounds greater in the 2-year-olds. While in a few individual cases the yearlings yielded a greater amount of tallow, yet in no one year was the average percentage of tallow yielded by the younger cattle as large as that of the older ones. The very low totals for tallow in the last year of the series (1905) seem to indicate that a large measure of success has been obtained by “show feeders” in their efforts to fit animals with a minimum amount of waste fat.

Regarding the average daily gains of the exhibits, although the exact age of the cattle is not given, it can reasonably be assumed that the difference was from six to twelve months, as some of the older ones had been exhibited both as yearlings and as 2-year-olds. Allowing them an average of twenty and thirty months, respectively, the average daily gain per head of the yearlings would be 2 pounds and of the 2-year-olds 1.65 pounds.

ORIGIN OF PRESENT SUPPLY OF BABY BEEF.

Calves which are fed for baby beef are derived from two sources—from the farms of the corn belt, where they are bred, fed, and finished, and from the range, the calves from the range being purchased at weaning time, when about 350 to 500 pounds in weight, and shipped east to be rapidly pushed to maturity.

Some men still hold that calves intended for baby beef should be bred by the feeder himself, who could then select thick-meated early maturing breeding stock, and thus be more sure of getting calves of a similar stamp. On the other hand, it may be said that the range cattle, by the continuous use of the best quality of purebred sires, have been improved to such a degree that in many herds they possess all the characteristics of purebred animals, and calves of this description which have been sent east and fed for baby beef have held their own with eastern-bred calves in topping the market. These range calves can generally be purchased at more reasonable prices than native calves of the same quality, owing to the lack of fattening feeds (especially corn) in the West and Southwest.

It may be said also that the large herds of the range offer greater choice for obtaining uniformity in size, type, and color. Uniformity in these respects is always an advantage, as it will make a lot of cattle more attractive to the buyer, and evidence of purity in breeding will generally bring a little more per pound in the stock yards than a mixture of color, unevenness in size, or a variety of types.

HOW TO PURCHASE CALVES.

In order to make any feeding operation profitable the stock must be obtained at a reasonable price, because even a purebred animal will not bring more on the block than its value for meat, and thus the original cost of the animal, together with the cost of the feed, must be smaller than the selling price. Calves may be bought by the pound or by the head, the latter being the most common way of buying and selling in the West and Southwest. The suggestion is made by Clay, Robinson & Co. that feeders unaccustomed to handling young cattle should buy them by the pound, because they are likely to overestimate their weight, thus at the outset assuming a serious handicap in a profitable sale.

FEEDING FOR BABY BEEF.

The digestive system of cattle consists of a stomach with four compartments, which, when fully developed, is especially adapted to convert coarse or bulky fodders into meat, fat, and heat. The first three compartments—the rumen, or paunch, the reticulum, or honeycomb, and the omasum, or manyplies—are not stomachs in the sense that they digest food, but are simply used in storing and softening coarse food not thoroughly masticated when swallowed. When the animal is at rest the food is returned from these compartments to the mouth to be remasticated, after which it goes directly to the fourth compartment, or abomasum (which corresponds to the real stomach of nonruminant animals), where it is digested and assimilated.

At the time of birth the first three compartments are very incompletely developed. According to Colin^a the rumen of the sucking calf holds only 2.6 pounds, the reticulum 0.22, and the omasum 0.35 pound, while the abomasum, or true stomach, holds 7.7 pounds. As the animal grows older the first three compartments are gradually developed and enlarged, the first (paunch) to such an extent that in the mature ox it is about nine times as large as the other three combined.

These conditions show that the calf must have feed which is easily digested, and which should contain a very much smaller proportion of bulk per pound of digestible matter than the feed for mature animals. The calf can not utilize coarse fodders to any extent until the first three compartments have become more developed, at least six months after birth. Its food, therefore, should consist of milk and wholesome grain, both being nutritious, easily digested, and form an excellent balance.

Cattle under one year old utilize so large a proportion of the frame and muscle forming constituents of the food and make such rapid

^a Feeds and feeding, Henry

growth of frame that it is often a difficult matter to induce fattening at a uniform rate, so as to produce a prime finish. Young calves which receive liberal quantities of whole milk will make rapid gains and get very fat. This fat, sometimes known as "milk fat," or "baby fat," is very economically produced, and some feeders claim that if this early habit of fat building is lost it is not easily regained. As young animals assimilate their food very thoroughly and make better use of the frame and tissue forming constituents, it is their natural tendency to grow in frame rather than in fat. Calves that are allowed to get thin during the first six months of their lives generally require a long time to overcome this check. Where early maturity is desired, such a system of feeding would be disastrous. The fattening should therefore begin with the whole milk at birth and should be continued until the animal is mature and ripe for the block.

Where very heavy feeding is resorted to, the length of the feeding period should not extend much over one year, as it seems to be the practical experience of feeders that under such circumstances remunerative gains can not be expected for a longer period, this length of time being about the limit which even a young animal can profitably stand heavy and continuous feeding.

FEEDING THE YOUNG CALF.

Whole milk is the most complete and most easily digestible ration for the calf, when considering any feed by itself. It contains all the nutrients necessary for growth the first few weeks of life, and if sufficiently supplied with it the calf will make a rapid growth of flesh and fat. Whole milk until weaning time will make the best calf for any purpose, but economy does not always permit the feeding of such milk and demands a cheaper substitute, especially in the case of calves intended for the dairy, where great development of flesh is not essential. In feeding whole milk it is preferable that the calf be allowed to run with the cow; this gives it an opportunity to take smaller quantities of food and at more frequent intervals, and thus avoids gorging the stomach with a large quantity at one time, and in taking the milk directly from the udder all contamination is avoided and the temperature is regulated to the point that nature intended. In feeding for baby beef, feeders find that the most profitable calves are those which have been kept thrifty and in good flesh since birth, and to this end it has been found most satisfactory to permit them to run with their dams from four to six months before weaning, while show calves are sometimes allowed to nurse cows for a year or more.

For the first few weeks the whole milk will meet all the requirements of the growing animal, but later on even whole milk will

become inadequate as a complete ration. As the digestive system develops, solid food becomes necessary and grain should be added, the amount being increased from time to time, according to the gradually increasing physical demands of the growing animal. Calves soon learn to nibble small quantities of shelled corn, or oats, or a mixture of the two, which, if supplied in a clean box and given fresh at every feeding, they eat with great relish. For this purpose it may be practicable, where calves run with their dams all day, to build a small inclosure containing a feed box with fresh grain, to which only the calves have access. In following up this system the calf can be fed to the limit of its capacity and the outdoor exercise will tend to keep it in good health. The grain should be gradually increased to form the basis of nourishment; then when weaning time comes the change is less sudden, and a check in growth or a loss in flesh is not likely to occur.

Where it is desired that the cow should yield a remunerative quantity of milk after weaning this system of running the calf with its dam is detrimental, as the frequent and imperfect milkings by the calf do not tend to develop the large flow of milk that would result from more regular and thorough milking at less frequent intervals, but tends rather to decrease it. It may, therefore, be more suitable under such circumstances to milk the cow by hand and feed the calf whole milk from the pail.

Another system which has also been practiced with success is to allow the calf to run with the cow for several weeks, after which they are separated and allowed to suckle three times daily, the cow being stripped after the calf has had its fill. The advantages of this method are that the calf gets its milk fresh at every feeding, while the cow is milked clean every day, and time is saved by letting the calf do the milking. It also permits a more gradual transition at weaning time if one of the sucklings is discontinued when the calf is about 3 months old, another when it is about 5, and the third when it is about 6 months old, by which time the calf will have become accustomed to the use of grain feed and to drinking water. This method is also recommended in the case of cows that yield a very heavy flow of milk, as such cows will often yield more than the calf requires for a thrifty growth, and thus produces digestive disorders.

Careful stockmen always regard sudden changes in feeding or in the management of cattle as injurious, as such changes are generally followed by a check in growth, or, if the new conditions are decidedly unfavorable, by a loss in flesh.

Weaning time is the greatest change in the animal's life, and many calves which are brought up under almost ideal conditions until weaning are stunted by too sudden a change, or subsequent neglect.

Regarding the effect of weaning Warfield says:

The weaning is in a great degree a crisis in a calf's life. If cut off from nature's diet too early bad results not infrequently ensue; but if allowed to go on to that period at which in the natural sequence of events the calf would find his milk ration more and more insufficient and his capacity to eat more and more perfect every day, the transition, instead of being violent, is at once natural and easy, and therefore without injurious consequences. The great thing is to keep the growth of the calf from suffering any check. If this growth goes right along, all well. If, however, the weaning is followed by a period of pining and real need of the milk diet, and the calf is for a few weeks unthrifty, the effect will be apparent in the animal's after life; for these short periods of retardation in early life count up largely in the sum. This is not an easy matter to impress upon many men, and yet an animal that has an unbroken calfhood of thrifty growth will mature earlier and develop more completely the possibilities of its nature than another which, with equal promise, was suffered to get again and again out of condition by unwise saving in the first months of its life.

SKIM-MILK CALVES.

The fact that the best results are generally obtained with whole-milk calves does not eliminate skim-milk calves from the range of possibility for baby beef. Whole milk is the ration balanced by nature, and if this balance could be exactly imitated by the use of other healthful food, it seems that there should be no good reason why calves fed on this substitute should not do equally well.

In restoring to skim milk as nearly as possible the qualities contained by whole milk, the skim milk must be warmed to the proper temperature (about 95° to 100° F.). The milk should be fed sweet. As milk sent to the creamery to be separated often returns soured or tainted, it may be suggested that the best way of securing sweet skim milk for the calf is by the use of a farm separator.

The chief difficulty that is met in the use of skim milk is, of course, to find an efficient substitute for the butter fat of whole milk. One of the best feeding stuffs at present known for this purpose is flaxseed meal. The latter contains a high percentage of oil, a low percentage of starch, and has a high rate of digestibility (Jordan), with a nutritive ratio very nearly the same as that of whole milk.

The best results from the use of flaxseed meal are obtained by boiling the meal in water and feeding the jelly thus obtained mixed with the skim milk. It should be fed in small quantities, not to exceed several tablespoonfuls, when the calf is first changed from whole milk to skim milk, which should be done gradually. As the whole milk is decreased the flaxseed meal may be proportionately increased, so that a pound may be fed at the end of a month or six weeks.

Some other feeds which are commonly used as substitutes for butter fat are oil meal (when made by the old process it contains about 4 per cent more fat than by the new process), oatmeal, and corn meal. Cotton-seed oil and corn oil have also been suggested. Of the latter one-half ounce per quart of milk was fed successfully at the Massa-

chusetts Experiment Station. None of these substitutes can, however, completely equal the advantages derived from the use of whole milk during the first month of the calf's life, but calves brought up on corn and skim milk have made as large gains after that age as calves which had the run with their dams.

The Kansas Experiment Station (Bulletin No. 113) reports larger gains from the use of skim milk than from whole milk and with less grain used with the skim milk.

The Iowa Experiment Station (Bulletin No. 35) in a series of experiments in feeding skim milk to calves obtained good results from flaxseed mixed with corn meal; ground oats gave about equal results; but oil meal not only made smaller gains, but increased the cost of the gains considerably over that from flaxseed and corn or oats.

Regarding the safety with which flaxseed can be fed, Curtiss, who conducted the above experiments, says:

This feed can not be fed in large quantities. We have only used it to the extent of about 10 per cent of the grain mixture (fed with corn). It is practical to replace considerable of the butter fat by substituting flaxseed, but it is very rich (containing about 35 per cent fat) and highly concentrated and unless fed judiciously produces derangement of digestion.

He further states regarding the economy of these feeds:

The results of all the investigations made at this station (Iowa) strongly indicate that it is not only poor economy but poor practice in feeding to use a highly nitrogenous product like oil meal in combination with separator skim milk. The practice has neither logical reason nor scientific theory for its support, and in the corn-belt States, with their surplus of corn and oats, there is no necessity for the purchase of a high-priced nitrogenous product to be used in supplementing the skim-milk ration.

Theoretically a ration can be compounded by the use of these various feedstuffs in combination with skim milk which will contain the properties of whole milk; but when put into practice it requires the most careful attention to reach even approximately the same results, as the animal can not utilize vegetable fats and oils to the same extent as the fat of milk. Oily feeds readily produce disorder in the digestive system, especially when fed in such quantities as would balance the amount of fat that would be derived from whole milk. Scours and loss of appetite are likely to result.

There is an old German adage that "the eye of the master fattens his cattle." This is especially applicable to the successful feeding of skim-milk calves. The digestive system of the animal is yet undeveloped and delicate; it is nurtured on feeds which are not always in accord with nature's prescription (whole milk). In order, therefore, to secure the largest possible gains it is absolutely essential that the feeding of artificial products be given the most careful attention to prevent any digestive derangement and also in order to guard against undernutrition.

Calves fed on skim milk tend to grow in frame rather than to fatten, although their gains may be as rapid as the gains made by calves fed on whole milk. The use of skim milk in producing baby beef therefore lengthens the period of production. When it is desired to have the calves thoroughly finished for the market in about twelve months, it is advisable that whole milk be resorted to, as the skim-milk calf generally requires from four to six months longer to acquire the same degree of finish.

FEED AFTER WEANING.

From the foregoing it is understood that the calf should be so thoroughly accustomed to the use of grain when weaning time comes that milk can be discontinued without any check to growth. From now on the key to the successful production of early matured beef is to hold the flesh already gained and to continue its rapid and steady growth. The method of feeding adopted to obtain such results will depend largely upon the nature of the feeds available and the season of the year. Previous to weaning the ration consists of whole milk supplemented by grain, or skim milk with a small amount of flaxseed jelly, or some other substitute to take the place of butter fat in addition to grain. Corn with milk produces an excellent balance of heat, fat, and muscle-producing feed. After weaning the protein of the milk must be restored by some other feed, although a relatively smaller proportion of it becomes necessary as the calf grows older.

In the summer time the best combination to furnish the proper balance is a good pasture (bluegrass is preferred for pasture, because it is firm and contains a large per cent of nutrients) and shelled corn or a little oats, if they are cheap enough. Occasionally a little cotton-seed meal, gluten meal, linseed meal, or bran may help to balance the ration and tend to stimulate the appetite. The relative proportion of these feeds will depend in a large measure upon their cost. If bluegrass pasture is not available clover or alfalfa pasture will supply sufficient muscle-producing feed, but such a pasture must be used with care. If calves are to be marketed very early in summer it may not be as profitable to turn them on grass as to finish on dry feed, especially if clover hay is very abundant or if the pasture is not very good. Corn furnishes the most economical feed for the production of fat and heat energy, and, as it is more easily fed and readily balanced, it should be relied upon as the principal constituent of the ration, forming from 50 to 75 per cent of the total concentrates given, whether summer feeding on pasture or feeding in the dry lot is practiced.

Some of the most successful feeders of baby beef have used silage (from 15 to 25 pounds daily) with good results in a ration consisting of about 3 pounds corn meal, 2 pounds wheat bran, and plenty of clover hay. In such a ration the silage will add the succulence, but if silage is not available a small quantity of roots will answer the same purpose.

As to the coarse fodders, there are a variety which will give good results; but, as has already been pointed out, calves can not utilize them as perfectly as older cattle, and while calves should have access to fodder of some kind the grain ration should be so liberal that they need not rely on the coarse fodder to any large extent, and the rough fodders given should not be too fibrous nor such as are difficult to digest.

Of all the fodders good clover or alfalfa hay have no equal, as they will supply the protein or muscle-making properties that must otherwise be supplied in the form of nitrogenous commercial products, which generally prove very expensive. If the roughness consists largely of such feeds as corn fodder, oat hay, timothy hay, or prairie hay, then some nitrogenous concentrate should be added to give the proper balance. Silage has been used with excellent results to substitute some of the bulky feed. A small quantity (15 to 25 pounds) is especially desirable, as it imparts succulence to the ration, and thus helps to sharpen the appetite; but where silage is not available a small allowance of roots can often be fed profitably. A variety of feeds, both of rough fodders and concentrates, can be used in compounding a well-balanced ration, and a closer study of these feeds on the part of the feeder will often result in a greater economy of producing meat and with better health to the stock.

The results obtained in an experiment by this Department in cooperation with the Missouri Experiment Station for the purpose of testing the value of corn as against mixed grains, on pasture, were in favor of mixed feeds when fed to yearlings or 2-year-olds. One of the mixed feeds consisted of one-fourth cotton-seed meal and three-fourths shelled corn; another was one-fourth linseed meal and three-fourths shelled corn; and yet another consisted of one-fourth gluten meal and three-fourths shelled corn. Regarding the value of these mixed feeds as against corn alone, Professor Waters writes: "In every case the younger cattle receiving mixed feeds became fatter, carried a better bloom, and were from every point of view more marketable."

The proportion of protein, or tissue and muscle forming material, to heat and fat-forming constituents in whole milk is about 1 of the former to 4 parts of the latter. This forms an excellent balance for the sucking calf. As the animal grows older it will be able to use more fat in its food and the ration can gradually be widened until it is about 1:5, or possibly 1:6.5, at the end of the first year. The Kansas Experiment Station found that 28 per cent of grain was saved by feeding a balanced ration consisting of a mixture of corn meal, oil meal, bran, and shorts over a ration consisting of corn only. (Bulletins Nos. 34, 39, and 60, Kansas Experiment Station.)

FEEDING METHODS.

The feeding of young stock requires much more care and attention than is necessary with older cattle. Young stock are much more subject to irregularities of the digestive system, and these are especially liable to follow the feeding of very heavy rations when it is done carelessly. To induce calves to eat the greatest possible amount and yet keep their appetite keen it is necessary to feed them regularly at stated times every day, as stock will become accustomed to eat at certain hours of the day and will often come to the trough at that time through force of habit, though they may not be particularly hungry. Under such conditions with a little effort they may often be induced to eat larger quantities than would otherwise be the case. Stale food has the same effect on stock as on human beings; it often takes the edge off the appetite, while a fresh supply of palatable food would be conducive to eating a hearty meal. When the desire for eating is thus aroused by the sight of food it not only induces a greater consumption of food, but stimulates the secretive organs of digestion, so that the food consumed is more thoroughly digested.

Young cattle should be fed more frequently than those nearly mature in age. The grain should be given in two or three feeds daily. If the grain is fed mixed with chopped roughage, it would probably be better to give three daily feeds, but if they have continuous access to the mangers for roughness, or if kept on pasture, two daily feeds of grain would probably be sufficient after the first six or eight months.

WATER AND SALT.

Fresh water should be accessible at all times. In the winter time it should be warmed to a temperature of about 50° to 70° F. When very cold water is given a great amount of heat energy is required to bring it to a normal blood temperature, and when water is given too cold calves often fail to drink a sufficient amount. The cost of heating water is very small. At the Kansas station, where five styles of heaters were used, the cost of warming water in a tank supplying from 5 to 10 head was found to be but a fraction over 3 cents daily, while it could be done just as cheaply for 35 to 40 head with same tank.

Salt should also be accessible at all times, as cattle on heavy feed generally show a strong desire for salt. As a great amount of effort is necessary to obtain a sufficient quantity of it when given in the form of rock salt, it would be advisable to give loose salt, but, like the feed, it should be supplied as fresh as possible by giving it frequently and in small quantities.

The preparation of feed for young stock requires more attention than is necessary with old cattle, because in the former the organs of digestion and mastication are not so well developed. Cooking is seldom resorted to in preparing feed for old cattle, because the advantage derived from feed thus prepared seldom pays for the expense and trouble connected therewith. For young calves cooking the feed is often done with profitable results. For example, hay tea, which is obtained by boiling hay in water, is generally regarded as an excellent food for calves and a good substitute for skim milk. Flaxseed can also be boiled profitably.

The grinding or crushing of grain fed to calves is a question of great importance. Young calves can chew shelled corn very readily, and there would probably be little advantage in grinding corn if the meal were fed dry. Smaller grains, however, such as barley, rye, oats, etc., are much harder to masticate thoroughly, and if fed freely, they should be ground or cracked. Grinding also permits of a better mixing of the feed, especially if mixed with the roughage. Meal when mixed with cut hay gives more bulk and when slightly dampened it adheres to the roughage. This insures a more thorough mastication of the meal and tends to keep the feed loose in the stomach, so that the digestive juices have a better chance to come in contact with all the feed. The same is true when corn is ground with the cob.

GREATER ECONOMY IN FEEDING YOUNG CATTLE.

It is well established that the cost per pound of increasing the live weight of cattle advances with age at the rate of nearly 50 per cent for every year after birth. This is accounted for by the fact that calves assimilate a large portion of the nitrogenous constituents of food (the digestible protein) in the form of muscle, blood, hair, horn, and connective tissue, while a large part of the mineral matter of plants—the lime and phosphoric acid—are retained in the body for the construction of bone. As the animal advances in age, this growth of body gradually ceases, and the nitrogen used in building up the framework becomes less necessary. After growth ceases only a small amount of nitrogen is necessary for repairing the broken-down nitrogenous tissue of the body, and whatever is fed in excess of this demand is voided by the animal and constitutes a waste. As protein contains, in addition to nitrogen, the same elements found in carbohydrates and fats, it has also the power to form fat, or heat energy, in the body, but only to the extent in which these elements are present. Comparing the protein of food with the fat and the carbohydrates, the potential

energy yielded by these food compounds as given by Henry is as follows:

Food compounds.	Potential energy.	
	Heat.	Mechanical.
	<i>Calories.</i>	<i>Foot-tons.</i>
In 1 gram of—		
Protein.....	4.1	6.3
Fat (ether extract).....	9.3	14.2
Carbohydrates.....	4.1	6.3

This shows that protein is theoretically about equal to the carbohydrates and a little less than half the value of fat for the production of heat or body fat. If the animal is still growing and can make use of all the nitrogen contained in protein, then feed rich in protein makes an economical ration. That young animals make a greater profit from the feed was shown by Soxhlet, who obtained 1 pound of increase in the live weight of calves from 1 pound of digestible milk solids. In this case nearly 70 per cent of the protein of the feed, 72 per cent of the phosphoric acid, and 97 per cent of the lime were utilized by the calf for the production of body tissue. Full-grown cattle under ordinary conditions require from 6 to 10 pounds of digestible dry matter to make 1 pound of gain. This serves to illustrate the economy with which growing animals will utilize feed, especially of a nitrogenous character.

DAILY GAINS OF CATTLE AT DIFFERENT AGES.

The daily increase in the live weight which can be made by calves fed on a liberal allowance of whole milk with some grain in addition is from 2 to 3 pounds, which is better than the daily increase made by full-grown steers. As calves are smaller, a proportionately smaller amount of food is necessary for maintenance of the body, which in the case of a full-grown steer would be from 7 to 8 pounds of digestible dry matter per 1,000 pounds of live weight.

Canadian experiments show the following results in regard to the influence of age on the cost of producing beef. (Canada Experimental Farms, Reports, 1903.) The animals selected were of as nearly uniform type and breeding as possible and were fed such rations as were best suited to them according to age. There were 9 animals in each of the first three lots and 6 in the last two. The length of time of feeding was one hundred and eighty days for each lot.

Ages.	Average daily gain.	Gain in 180 days.	Cost per 100 pounds gain.
	<i>Pounds.</i>	<i>Pounds.</i>	
3-year-olds.....	1.58	284	\$7.05
2-year-olds.....	1.65	298	6.03
Yearlings.....	1.65	298	5.51
Six months' calves.....	1.46	263	5.33
Skim-milk calves, new-born.....	1.48	273	2.16

In combining the results of two experiments carried on in 1900 and 1901, the purpose of which was to study the comparative cost of feeding a heavy ration from birth to block against feeding a growing ration from birth for about two years and feeding a heavy fattening ration for five or six months previous to slaughter, Grisdale^a obtained the results given below.

Comparative results of feeding baby beef and long-fed beef.

Particulars for comparison (one steer considered always).		Baby beef (average of 10 steers).	Long-fed beef (aver- age of 10 steers).
Days on feed.....	number.....	700	913
Weight when put on experiment.....	pounds.....	122	107
Weight when slaughtered.....	do.....	1,297	1,235
Gain during feeding period.....	do.....	1,175	1,128
Daily rate of gain.....	do.....	1.68	1.26
Amount of feed eaten:			
Roots and ensilage.....	do.....	15,793	19,529
Hay.....	do.....	1,150	1,315
Skim milk.....	do.....	1,645	1,592
Rape.....	do.....	70	
Meal.....	do.....	3,809	1,405
Pasture.....	months.....		9
Total cost of feed.....	dollars.....	63.06	59.66
Cost per 100 pounds increase live weight.....	do.....	3.35	5.29
Selling price per 100 pounds live weight.....	do.....	5.62	4.78

The average weight of the cattle at the end of the feeding period was larger in case of the baby beef fed 700 days than that of the older cattle fed 913 days; the cost of the increase per 100 pounds was practically the same, being only 6 cents higher with the baby beeves, but the great margin in the selling price indicates that the latter were better finished. Subtracting the cost of production from the selling price, the baby beeves gave a profit of 27 cents per 100 pounds, while the long-fed steers show a loss of 51 cents per 100 pounds.

According to Henry (Feeds and Feeding), the sucking calf should gain 3 pounds a day for the first month, 2.5 pounds for the second, and 2 pounds for subsequent months.

The following examples show the rate of gain made by yearling cattle exhibited at the International Live Stock Exposition in December, 1905:

A load of yearlings exhibited by Mr. J. G. Imboden went into the feed lot January 1 weighing 325 pounds and at show time had gained 700 pounds a head, indicating an average daily gain of about 2 pounds a head for a period of over eleven months. Another load fed by the same man made practically the same gains.

A load of yearlings fed by Funk Brothers weighed, when put into the feed lot, January 1, 275 pounds per head and at show time tipped the scale at 1,210 pounds, indicating a daily increase of live weight of nearly $2\frac{3}{4}$ pounds for a similar period.

^aCanada Experimental Farms, Reports, 1903.

One load of yearlings, bred on the range and fed by D. J. Black, of Ohio, went into the feed lot weighing 475 pounds and at show time averaged 1,240 pounds.

Escher's Angus cattle, champion yearlings in 1904, were weaned in October, when they weighed about 450 pounds, fed on ear corn, oats, oil cake, and hay during the winter following. In spring the corn was ground and supplemented by oats, bran, and oil meal. In addition they had a good bluegrass pasture. They weighed at show time about 1,200 pounds, having gained approximately 750 pounds a head in about thirteen months.

The yearling Shorthorn champions, exhibited by J. D. Waters, were weaned about the same time, weighing about 500 pounds. They were fed on cut feed, corn, and hay, and at harvest time oats were added to the ration. During the summer they were on bluegrass pasture. Two months previous to the show they were given ground corn and oats in equal parts, with abundance of cut hay and a limited quantity of sorghum. When shown they weighed 1,350 pounds, having gained 850 pounds per head in about thirteen months.

A load of Nebraska range-bred Herefords, fed by C. C. Judy, went into the feed lot in the fall, when they weighed 325 pounds. They were fed on corn, oats, and a little oil meal, and had made an average increase per head of 775 pounds when exhibited the following year.

A load of yearlings bred below the quarantine line and fed in Illinois by Steiner Brothers made an average gain of 802 pounds in eleven months, or close upon $2\frac{1}{2}$ pounds a day.

SECTIONS ADAPTED FOR RAISING BABY BEEF.

The location most naturally adapted for the production of baby beef is the farming section of the country where a variety of concentrated feeds, especially corn, is available, and where the number of stock kept is proportionately small, so that constant care and attention can be devoted to their feeding and management. Missouri, Iowa, Illinois, Kansas, Nebraska, and Minnesota produce most of the baby beef that goes on the market to-day; Michigan, Indiana, Ohio, and Wisconsin produce it to a more limited extent. Whether or not some sections in the East and the South could profitably produce beef of this class depends to a certain extent upon the methods of farming which are carried on in those localities. In most of the States and sections named, except New England, corn forms one of the chief agricultural products, while nitrogenous concentrates, in addition to those obtained in the form of dairy by-products, are abundant in the form of leguminous fodder crops, such as clovers, alfalfa (the latter having been grown successfully in some sections of the East), cow-peas, etc. The cotton lands of the South also furnish the highly

nitrogenous cotton-seed meal which now forms a material factor in beef production in the North.

Proximity to good markets and good shipping facilities are factors of great value in selecting a location, as they afford the opportunity to take advantage of sudden market fluctuations, while reducing the large shrinkage which inevitably results from shipping long distances.

The climate is a factor of only secondary consideration, since extremes of either heat or cold can be moderated by the construction of shelter, etc.

LOCATION OF THE FEED LOT.

The feed lot should be dry, sunny, and well protected from cold or raw winds. The best location is one that is elevated on the north with a good slope toward the south or east, thus offering a rapid surface drainage. This is especially important in clayey soils which are impervious to water, and in localities where the ground freezes to a great depth, as underground drainage will not carry off the water so long as there is frost above the pipes and thus the yards are often in a muddy, almost impassable condition for several weeks during the spring season. Protection on the north and west sides by a barn, a shed, a tight board fence, or a dense row of trees will make the feed lot more conducive to outdoor exercise. Rather large feed lots are preferable, as they may be kept cleaner and offer more room for exercise.

SHELTER.

Cattle will make the most gain for the feed consumed when they are comfortable in every respect. Extremes of heat or cold give discomfort and should be guarded against. The character of the shelter that is to be provided for this purpose will depend largely upon the severity of the climatic conditions. Where the climate is extremely cold a large amount of food is necessary to maintain a certain temperature of the body, while excessive exposure to the sun in a hot climate gives discomfort, creates restlessness, and often takes the edge off the appetite.

Young animals, being smaller, have a comparatively larger exposure of body surface. They are more tender than older animals and consequently more susceptible to extremes, especially to cold weather. In the summer time the baby-beef calves should be kept in darkened quarters where they are protected from the sun and from flies during the hottest hours of the day.

Better success is usually obtained from feeding baby beeves indoors during the winter, provided their quarters are kept dry and well bedded and supplied with good ventilation. Under these conditions the calves can generally be given more individual attention as to

feed. A very successful feeder of baby beef in the Central West, who feeds his calves indoors but turned loose in pens, reports an average daily gain of 3 pounds a head from 20 head for the first month of indoor feeding. This gain was made from a ration consisting of 3 pounds corn meal, 2 pounds wheat bran, and 20 pounds of silage, with clover hay unlimited in quantity. When calves are fed indoors they should have access to small lots where they can take a little exercise and sun themselves occasionally, as this will tend to keep them in better health.

MANAGEMENT OF HEIFERS.

Open heifers come in heat at certain intervals after they are about a year of age. During these periods they are very excitable and if kept with steers or other heifers they get the whole herd excited, not only losing flesh themselves but causing the whole herd to slacken in their gains. Heifers therefore should be watched. Upon coming in heat they should be separated immediately from the herd, and, if practicable, they should be kept in a box stall for a few days.

For this reason heifers which have been spayed are generally preferred by the feeder, and buyers also give them the preference, because there is no chance of their being in calf. The spaying of heifers involves more danger and requires more skill than castrating bull calves, and it is therefore not so generally practiced.

DISEASES.

The most dangerous enemy to the production of baby beef is the disease known as blackleg, or symptomatic anthrax, which is caused by infection with a germ which enters the system through abrasions or contusions of the skin.^a This disease, which in some European countries has become the most destructive disease among cattle, has been observed in nearly all the States of the Union except the southern Atlantic and eastern Gulf States. The cattle which are most frequently affected are the young stock between 6 and 18 months of age, and highly-bred animals are more susceptible than common or low-grade stock, because their skin is more delicate. High feeding and lack of exercise create conditions in the animal which favor the rapid growth of the germs and increase the virulence of the disease. As curative measures are of no assistance in combating the disease, preventive measures must be depended upon. It is recommended that calves should be vaccinated with blackleg vaccine before they have reached the age when they become most susceptible to the disease, which is about six months after birth. If, however, the district be infected, all the stock should be vaccinated at once, regardless of age.

^a See Bureau of Animal Industry, Circular No. 31.

BABY BEEF ON THE MARKET.

While the term "baby beef" is very frequently used in speaking or writing of a certain market class of cattle, the market reports never quote prices for cattle under this name. It might, therefore, be more or less difficult to know exactly in which of the classes such cattle would be quoted or what price they would command.

It has already been stated that the meat from thoroughly finished yearling cattle is as popular on the market to-day as that of cattle more mature in age, provided demand and prices paid rather than the numbers marketed are taken as a criterion. This is well illustrated by the following, taken from the annual live stock report (1904) of the Union Stock Yard and Transit Company, Chicago:

One of the most notable features of the year has been the unprecedented demand for choice, well-bred, fat young cattle, called "baby beef," and at no time was there a dull spot during the whole season for this class of young cattle. Choice yearlings were in demand all the time and the best qualities sold up among the top notchers. There is no question but that "baby beef" has come to stay, and it is as popular with consumers abroad as in this country.

The conditions prevailing on the Chicago market for 1905 were very similar to those in 1904. Prime yearlings sold as high as older cattle with equal finish, but as the supply of such young cattle fit to qualify as baby beef has been small in comparison with that of prime 2-year-olds and 3-year-olds, it is yet questionable whether the demand for the younger beeves would equal or exceed that for the older if the market were equally well supplied with them. At present, however, the demand for baby beef is so inadequately supplied that they find a ready sale at top prices, even on dull market days when the trade for older cattle is more depressed.

NUMBER MARKETED.

Regarding the comparative numbers of baby beeves, yearlings, 2-year-olds, and 3-year-olds put on the market during the past year, Clay, Robinson & Co. give the following information:

It is impossible for anyone to give statistics on this point, as no records are kept of the ages of cattle; hence we can only give our best opinion, based upon observation throughout the year. As a matter of fact the number of cattle marketed at a year old, or thereabouts, is very insignificant as compared with the 2-year-olds and 3-year-olds. Our salesmen estimate that of the fat cattle they handle not to exceed 1 per cent are yearlings. They further state that 2-year-olds and 3-year-olds are marketed in about equal proportions, possibly rather more of the 2-year-olds than of the 3-year-olds.

Of the yearling cattle that come to this market to be sold as beef there is not to exceed 1 carload in 10, and probably it would be nearer correct to say 1 in 12, that could be considered in prime beef condition. The balance are short fed [fed about five months] and sell at considerably lower prices per hundredweight than the finished animals.

During the year 1905 the receipts of cattle at Chicago totaled 3,410,469, of which it is estimated there were 390,000 western rangers

and 80,000 Texans, leaving 2,940,469 natives. Applying the above proportions to these figures we would obtain for the yearly receipts of native cattle approximately 29,400 yearlings, against 1,500,000 of 2-year-olds and nearly the same number of 3-year-olds. Carrying the computation still further, we find that only 3,000 to 4,000 prime yearlings, or baby beeves, are marketed during the year, and the proportion of this class of cattle brought to other markets would probably be still smaller.

MARKET CLASSES OF CATTLE.

For the convenience of the trade a system of classification is used by trade and stock journals which divides the cattle into classes and grades, in order to quote approximately the relative prices that are paid for cattle of a certain quality.

The class indicates the use to which the cattle can be put to best advantage, while the grade represents the degree of excellence within a class.

Beef cattle.—Prime steers; choice steers (these two include baby beef); good steers; medium steers; common rough steers.

Butcher stock.—Prime heifers; choice heifers (these two include baby beef); good heifers; medium heifers; prime cows; choice cows; good cows; medium cows; common rough steers; choice bulls; good bulls; medium bulls.

Cutters and canners.—Good cutters; medium cutters; common cutters and good canners; medium canners; inferior canners; bologna bulls.

Stockers and feeders.—Fancy selected feeders; choice feeders; good feeders; medium feeders; common feeders; inferior feeders; feeder bulls; fancy selected yearling stockers; choice yearling stockers; good yearling stockers; medium yearling stockers; common yearling stockers; inferior yearling stockers; good stock heifers; medium stock heifers; common stock heifers.

Veal calves.—Good; choice; medium; common.

The above general classes really comprise everything in the way of cattle sent to the markets. But there are a number of special classes generally recognized which require to be named and defined:

Subclasses.—Texas and western range cattle; distillers.

Miscellaneous classes.—Baby beef; export cattle; shipping steers; dressed beef cattle; stags.

The following classification, by Prof. H. W. Mumford, condensed from the Illinois Experiment Station Bulletin No. 78, and published in Farmers' Bulletin No. 184, will serve to illustrate the requirements for the various classes:

GENERAL CLASSES.

Beef cattle.—This class includes all grades of fat steers and heifers; also everything from common to prime and from light to heavy. It is finished condition that brings animals into this class.

Butcher stock.—This class includes animals that have not fattened well; also animals that have not been fed long enough to become properly fattened. It seldom

includes steers of really good quality, as such will usually be sold as feeders. The bulk of butcher stock is made up of cows and heifers.

Cutters and cannors.—In this class are included old, thin cows and very thin bulls, steers, and heifers. The cutters must carry sufficient flesh to permit of the loin or rib or both being used for cutting on the block. Those animals which are so thin that no part of the carcass can be used for block purposes constitute the cannors.

Stockers and feeders.—This class includes calves, yearlings, 2-year-olds, and older cattle. Cattle 18 months old or older which are ready for immediate use in the feed lot are called feeders. Those which are younger are referred to as stockers.

Veal calves.—This includes all calves which are sold for immediate slaughter.

SPECIAL CLASSES.

Texas and western range cattle.—A few years ago the typical Texas steer had very long horns and long legs, was thin and narrow-bodied, and carried a large, deep brand, and most of the cattle which came from Texas were of this description; but this type is rapidly disappearing. Animals of the best beef breeds have been imported into the State and used for breeding purposes, especially for crossing with the native stock, so that now many of the Texas cattle compare favorably with those from other sections of the country. There is, however, a very wide range between the best and the poorest.

The western range cattle are classed with the Texas cattle, because formerly they were made up largely of southern cattle which were driven northward to winter on the ranges north of the quarantine line. Now, however, a large percentage of the animals in this class are bred on the ranges of the West and Northwest.

All the cattle in this class are branded.

Distillers.—These are cattle that have been fattened on the by-products of distilleries. Formerly only inferior grades of cattle were purchased for feeding on distillery residues, but at present many feeders of better grades are used. When sent to market these cattle are preferred to others of the same grade, because they dress out a higher percentage of beef.

Baby beef.—This term is applied to choice or prime fat steers between 1 and 2 years old, weighing from 800 to 1,000 pounds.

Export cattle.—The cattle exported are in the main good to choice steers, weighing from 1,200 to 1,500 pounds. Comparatively few prime beef steers are bought for export, because of the high price they bring in the home market.

Shipping steers.—This term applies to the animals purchased in the western markets for shipment to the large eastern markets of the United States. They are mainly of medium and good grades and range in weight from 1,150 to 1,600 pounds.

Dressed beef cattle.—This class includes such cattle as are purchased by the large packing concerns of the Middle West. The packers prefer medium to choice steers, weighing from 1,200 to 1,400 pounds, to make up the bulk of their purchases, but conditions of supply and demand cause them to purchase animals of a much wider range in grade and weight, the extreme range in weight being from 800 to 1,700 pounds.

Stags.—This class includes such animals as have reached or at least approached maturity before castration, and hence have the general conformation of bulls. Comparatively few of these come to the general markets, and they are of a wide range in quality, condition, and weight. A few are good enough for export, while the poorest must be sold for cannors.

CONCLUSION.

Earlier maturity has been the continuous aim of progressive breeders of live stock, and its imperative necessity is one of the chief features brought out by the fat-stock shows of the present day. Most hogs (except breeding stock) are now matured and sold before they are 12 months old, and a large proportion of the sheep of mutton breeds are fed for the market and sold before they have reached that age. While the minimum age of maturity seems to have been closely approached with both hogs and sheep, this does not seem to be so generally the case with cattle. At a time when steers were marketed at 4 and 5 years of age, finished 2-year-olds were considered an early matured product. Five years ago, and even more recently, a prime steer up to 24 months of age was classed as baby beef, while to-day it is becoming questionable whether an animal over 18 months of age should be considered as such.

Some of the principal advantages derived from the production of baby beef as compared with older beef are (1) the quick returns on the investment, (2) the greater demand for the product, and (3) the greater amount of meat produced per pound of feed consumed.

In feeding baby beef the profit comes in within two years after birth of the calf. In case, also, of the loss of an animal this would be considerably smaller in a young animal, because the latter represents a smaller bulk and has, moreover, been produced at less cost per pound of live weight. On the other hand, the lighter the animals are marketed the more breeding stock is necessary to produce an equal amount of marketable beef. The extra cost of keeping this additional number of breeding stock, however, is offset by doing away with the cost of keeping steers the third year; thus the number of marketable stock kept on the farm is increased.

The production of baby beef involves a question of economics, based on the law of "diminishing returns," which has already lowered the age at which stock is matured by one-half of what it once was. No feeder of the present day would think of keeping a steer four, five, or more years, even if he could sell him at the same price per pound as younger stock, because it would decrease the number of marketable stock; and the same principle is true as regards 2-year-olds and yearlings, only in a less degree.

There are two factors connected with the attainment of earlier maturity, (1) better breeding and (2) better feeding, and it appears certain that those breeders and feeders who make the most of their opportunities along these lines will make the greater profits.